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| APPLICATION NO.                | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--------------------------------|-------------|----------------------|---------------------|------------------|
| 10/719,905                     | 11/21/2003  | Geun Su Lee          | 30205/39508         | 4042             |
| 4743                           | 7590        | 03/07/2005           | EXAMINER            |                  |
| MARSHALL, GERSTEIN & BORUN LLP |             |                      | ASHTON, ROSEMARY E  |                  |
| 6300 SEARS TOWER               |             |                      | ART UNIT            |                  |
| 233 S. WACKER DRIVE            |             |                      | PAPER NUMBER        |                  |
| CHICAGO, IL 60606              |             |                      | 1752                |                  |

DATE MAILED: 03/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/719,905             | LEE                 |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | Rosemary E. Ashton     | 1752                |  |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 21 November 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,5-9,12-18 and 20 is/are rejected.
- 7) ☒ Claim(s) 4,10,11 and 19 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

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## DETAILED ACTION

## Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

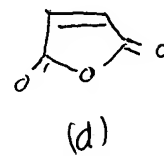
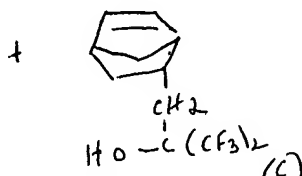
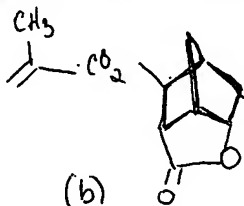
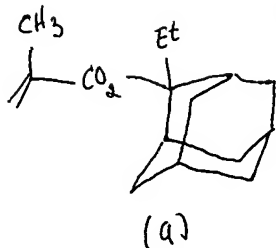
(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1,3,12,13,14-18,20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takata et al. U.S. patent application publication US 2003/0068573 A1.

In section 167, Example 4 Takata teaches a copolymer (Resin A4) comprising the following monomers.

(a)  
**[0167]** 9.9 g of 2-Ethyl-2-adamantyl methacrylate, 8.9 g of 5-methacryloyloxy-2,6-norbornenelactone, (b) 16.5 g of 5-norbornene-2- (2,2-ditrifluoromethyl-2-hydroxy)ethyle (c) and 5.9 g of maleic anhydride (d) were charged (molar ratio, 20:20:30:30), and methyl isobutyl ketone was added in an amount of two-fold by weight of the total monomer weight. Then, the mixture was heated up to 75° C. under a nitrogen atmosphere. To this was added dimethyl 2,2'-azobis(2-methylpropionate) as an initiator in a proportion of 3 mol % based on the total monomer weight, and the mixture was heated at 80° C. for 15 hours. Then, an operation of pouring



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2a  
3/6/05

The ethyl adamantly is an acid labile group and meets the limitations of monomer c and R3 and the methacryloyloxy norbornenelactone is a cycloalkyl including an ester group and meets the limitations of monomer d and R4. The norbornene ditrifluoromethyl hydroxyl ethylene ~~and~~ meets the limitations of monomer a, m is 1, n is 0, X1 is CH2 and maleic anhydride ~~and~~ meets the limitations of monomer b.

Tanaka does not teach the amount of each monomer as in the instant application other than monomer e is 0 %, however, it would have been obvious to one of ordinary skill in the art to vary the monomer ratios with a reasonable expectation of obtaining a polymer for a photoresist composition having improved line edge roughness because variation of monomer amounts is well known in the polymer art.

Table I in col. 9 shows resin A4 in a photoresist solvent with a photoacid generator and a solvent as in claim 9. The solvent comprises propylene glycol methyl ether acetate as in claim 13.

The amount of PAG is 0.1 to 20 wt. % (section 147) as in applicant's claim 12,

The method of forming a resist pattern is shown in section 185 and meets the limitations of claims 15-18 and 20. The PEB of example 9 is in Table 1 and is 130 deg. C.

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takata as applied to claim 1 above, and further in view of Hatakeyama et al U.S. patent no. 6,461,789.

Takata teaches the acid labile group is an ethyl adamantly group but does not teach the acid labile group is one of the substituents in claim 2.

In col. 5 Hatakeyama teaches a polymer for a photoresist composition comprising acid labile tertiary alkyl groups wherein the groups are a t-butyl group or an ethyl adamantly group as shown below.

**Examples of the tertiary alkyl group represented by formula (5) include tert-butyl, triethylcarbyl, 1-ethylnorbornyl, 1-methylcyclohexyl, 1-ethylcyclopentyl, 2-(2-methyl)adamantyl, 2-(2-ethyl)adamantyl, and tert-amyl.**

It would have been obvious to one of ordinary skill in the art to use a t-butyl group, rather than an ethyl adamantly group as the acid labile group, with a reasonable expectation of forming a polymer for a

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photoresist composition having improved line edge roughness because Hatakeyama teaches either a t-butyl group or a ethyl adamantly group may be used as an acid labile group in a photoresist polymer.

5. Claims 5,6 rejected under 35 U.S.C. 103(a) as being unpatentable over Takata in view of Ito et al. U.S. patent application publication US 2002/0146638, published 10/10/02.

As shown above Takata teaches a polymer having the monomers claimed by applicant. The free radical polymerization method of making the polymer, as shown above, is to combine the monomers in solvent, heat to 75 deg. C, add an initiator and heat again at 80 deg. C for 15 h with the last three steps under nitrogen atm. Takata does not teach the method of claim 5, however, the only difference in the method of Takata and claim 5 is that the monomers are not heated prior to addition of the initiator as in claim 5 and the polymerization temperature is 80 deg. C, not 70 deg. C as in claim 5.

Ito teaches a method of polymerizing (trifluoromethyl)acrylic acid and norbornene, as shown below, that meets the limitations of the method of claim 5.

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#### EXAMPLE 7

**[0096] Free Radical Copolymerization of TFMAA with Norbornene (NB):**

**[0097] TFMAA (0.056 g, 0.46 mmol) and NB (0.037 g, 0.45 mmol) were dissolved in dioxane (0.5215 g) along with AIBN (0.0071 g, 0.043 mmol) as initiator. The mixture was deaerated by repeating freeze-thaw cycles and heated at 70° C. under nitrogen for about 24 hours. The polymer was isolated by precipitation in hexanes, providing 72% yield. The copolymer contained TFMAA and NB at a ratio of 65:35, had a number average molecular weight of 2,200 and a weight average molecular weight of 2,900.**

It would have been obvious to one of ordinary skill in the art to use the free radical polymerization method of Ito, rather than the free radical polymerization method of Takata, to form the copolymers of Takata with a reasonable expectation of forming a polymer for a photoresist composition because both

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methods form a copolymer comprising norbornene and carboxyl group monomers for a photoresist composition.

As to claim 6 Takata teaches the solvent is MEK and Ito teaches the solvent is dioxane, both are known polymerization solvents.

As to claim 7 Ito teaches the initiator is AIBN.

6. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takata as applied to claim 1 above, and further in view of Lee et al U.S. patent no. 6,403,281.

As shown above Takata teaches a photoresist polymer having the monomers claimed in the instant application.

Takata does not teach crystallization of the polymer product.

In claim 9 Lee teaches crystallization of the polymer product as shown below.

**9. The process according to claim 5, wherein said process further comprises the step of purifying said polymer by crystallization using a crystallization solvent selected from the group consisting of diethylether; petroleum ether; alcohol; water; and mixtures thereof.**

It would have been obvious to one of ordinary skill in the art to crystallize the polymer product of Takata with a reasonable expectation of obtaining a purified polymer because Lee teaches crystallization of a polymer having norbornene groups for a photoresist composition. It is well known in the polymer art that crystallization provides a polymer having increase purity.

***Allowable Subject Matter***

7. Claims 4,10,11,19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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8. The following is a statement of reasons for the indication of allowable subject matter: The prior art does not teach the specific copolymer in claim 4, the photoacid generator in claims 10 and 11 or the exposure energy in claim 19.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rosemary E. Ashton whose telephone number is 571-272-1326. The examiner can normally be reached on Mon-Fri, 11:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia Kelly can be reached on 571-272-1526. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Rosemary E. Ashton  
Primary Examiner  
Art Unit 1752

March 6, 2005

ROSEMARY ASHTON  
PRIMARY EXAMINER